

Redescription of *Hymenolepis hoploporus* Dollfus, 1951, with the erection of the new genus *Dollfusilepis* (Cestoda, Hymenolepididae)

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Redescription of *Hymenolepis hoploporus* Dollfus, 1951, with the erection of the new genus *Dollfusilepis* (Cestoda, Hymenolepididae). - The monotypic genus *Dollfusilepis* is erected for *Hymenolepis hoploporus* Dollfus, 1951, until now known only from *Podiceps cristatus* (Aves, Podicipedidae) in Morocco. *D. hoploporus* comb. n. is recorded from the same host species in Bulgaria and Switzerland (new geographical records). The cestodes identified by JOYEUX & BAER (1950) as *Hymenolepis capillaris* are recognized as *D. hoploporus*. The species is redescribed based on specimens from Bulgaria, Switzerland and syntypes from Morocco. Among the genera of the family Hymenolepididae, the new genus *Dollfusilepis* is unique by the peculiar structure of the genital apparatus presented by a protrusible poral part of the cirrus-sac armed with a crown of refractive, baton-like spines.

Key-words: *Dollfusilepis* gen. n. - *Dollfusilepis hoploporus* comb. n. - Hymenolepididae - Cestoda - *Podiceps cristatus* - Bulgaria - Switzerland - Morocco.

INTRODUCTION

Hymenolepis hoploporus Dollfus, 1951 was described from the intestine of *Podiceps cristatus* (L.) in Morocco. Up to now, there were no other records of this species. Recently, it was found in three specimens of *P. cristatus* during faunistic studies on cestodes from grebes from the Bulgarian coast of the Black Sea. The material consisted only of strobilar fragments and, therefore, for the purposes of more reliable identification, they were compared with types from the collection of the Muséum National d'Histoire Naturelle, Paris.

On the other hand, in the course of taxonomic revision of hymenolepidid cestodes from Palaearctic grebes, we reexamined specimens of JOYEUX & BAER (1950) from the collection of the Muséum d'histoire naturelle in Geneva. The cestodes identified as *Hymenolepis capillaris* (Rudolphi, 1810) were found to closely resemble *H. hoploporus*.

The aim of the present paper is to redescribe *Hymenolepis hoploporus* on the basis of specimens from Bulgaria, Morocco and Switzerland and to clarify its generic allocation. On this basis, *Dollfusilepis* gen. n. is proposed for it.

MATERIALS AND METHODS

Specimens of *Dollfusilepis hoploporus* were collected from the small intestine of three birds of *Podiceps cristatus*. The grebes were captured at the village of Krapec, on northern part of the Bulgarian Black Sea coast.

Cestodes were isolated from intestines alive, relaxed in tap water, fixed in 10% formalin solution and preserved in 70% ethanol. Specimens were stained in iron acetocarmine, dehydrated in alcoholic series, cleared in eugenol and mounted in Canada balsam. The material examined from Bulgaria consists of about 30 fragments of strobila in different stages of development, stained and mounted in Canada balsam (total 10 slides); scoleces were not found. Voucher specimens (2 slides) are deposited in the Muséum d'histoire naturelle, Geneva, Nos 23,629 INVE and 23,630 INVE.

Comparative material: the following syntypes and voucher specimens were studied:

- from the collection R.-Ph. Dollfus, Muséum National d'Histoire Naturelle, Paris, syntypes, from intestine of *Podiceps cristatus*, 16 October 1926, Rabat Sale, Morocco (2 slides, whole mounts): 1 slide containing stained fragments of strobila; 1 slide containing a scolex.
- from the collection of the Muséum d'histoire naturelle, Geneva, Nos 089/035-037, specimens identified as *Hymenolepis capillaris* (Rudolphi, 1810) and mentioned by JOYEUX & BAER (1950), from intestine of *Podiceps cristatus*, Neuchâtel (3 slides, whole mounts): 1 slide containing a stained single specimen and several additional fragments of strobila; 1 slide containing stained strobilar fragments; 1 slide containing scolex.

The measurements of the cirrus-sac, the external seminal vesicle and the seminal receptacle were taken from mature proglottides.

The metrical and meristic data are given as the range, the mean in parentheses and the number of measurements or counts taken (n). The measurements are given in micrometers unless otherwise stated.

DESCRIPTIONS

Dollfusilepis gen. n.

Strobila protandrous, slender. Scolex round. Rostellar apparatus musculo-glandular. Rostellum armed with single crown of ten hooks. Each rostellar hook consisting of aploparaksoid refractive particle and epiphyseal thickening of handle. Suckers round, unarmed. Proglottides craspedote, wider than long. Inner longitudinal muscle bundles numerous. Genital pores unilateral. Genital ducts dorsal to osmo-regulatory canals. Testes three, arranged in triangle, usually one of them porally to female primordia. External seminal vesicle oval or elliptical. Internal seminal vesicle large, elliptical. Cirrus-sac elongate, reaching mid-line of proglottis, often extending

to antiporal osmoregulatory canals. Poral end of cirrus-sac protrusible, provided with basal crown of baton-like refractive spines. Cirrus narrow, unarmed. Accessory sac and stylet lacking. Female glands disposed antiporally. Ovary with three compact lobes. Vitellarium oval, compact. Seminal receptacle voluminous, elliptical. Vagina with funnel-shaped, thick-walled, muscular copulatory part, surrounded with cellular sleeve and thin, tubular conductive part. Uterus sac-like, situated anteriorly and dorsally to female glands.

Specific parasites of *Podiceps cristatus* (Podicipedidae). Palaearctic.

Type-species: *Hymenolepis hoploporus* Dollfus, 1951.

Dollfusilepis hoploporus (Dollfus, 1951) comb. n.

(Figs 1-16)

Hymenolepis (Weinlandia) hoploporus DOLLFUS, 1951

Dubininolepis hoploporus (Dollfus, 1951) YAMAGUTI 1959

Variolepis hoploporus (Dollfus, 1951) SCHMIDT 1986

Hymenolepis capillaris (Rudolphi, 1810), JOYEUX & BAER (1950).

DESCRIPTION OF SPECIMENS FROM BULGARIA (Figs 1-6: for some measurements see Table I): Strobila slender, band-like, with maximum width at post-mature proglottides. Proglottides (Figs 1-3) craspedote, always wider than long. Inner longitudinal muscle bundles more than 40. Genital pores unilateral, situated at about middle of lateral proglottis margin. Genital atrium (Figs 4-5) deep, funnel-shaped, thick-walled; divides into two separate canals: male and female. Atrium surrounded with intensely stained cells; when the cirrus is evaginated, atrium forming short genital papilla. Ventral and dorsal osmoregulatory canals without transverse anastomoses. Diameter of ventral osmoregulatory canals 18-36 (26, n=10), diameter of dorsal osmoregulatory canals 3-5 (5, n=10). Genital ducts dorsal to osmoregulatory canals.

Strobila protandrous. Testes (Fig. 1) three, compact, oval, situated in triangle, one poral, two antiporal to vitellarium. External seminal vesicle elliptical or oval, situated dorsally to female glands, near to antiporal osmoregulatory canals. Cirrus-sac (Figs 1-2) thin-walled, highly elongate, crossing mid-line of proglottis and often extending to antiporal osmoregulatory canals. Intensely stained cells surrounding ductus ejaculatorius. Internal seminal vesicle very long, fills up almost 2/3 of cirrus-sac. Poral end of cirrus-sac (Figs 4-6) protrusible, cylindrical when everted, forming wide ductus when withdrawn; provided with basal crown of baton-like refractive spines; number of spines 30-35 (34, n=7), their length 6-7 (7, n=5). Evaginated cirrus (Fig. 6) thin, almost cylindrical, unarmed.

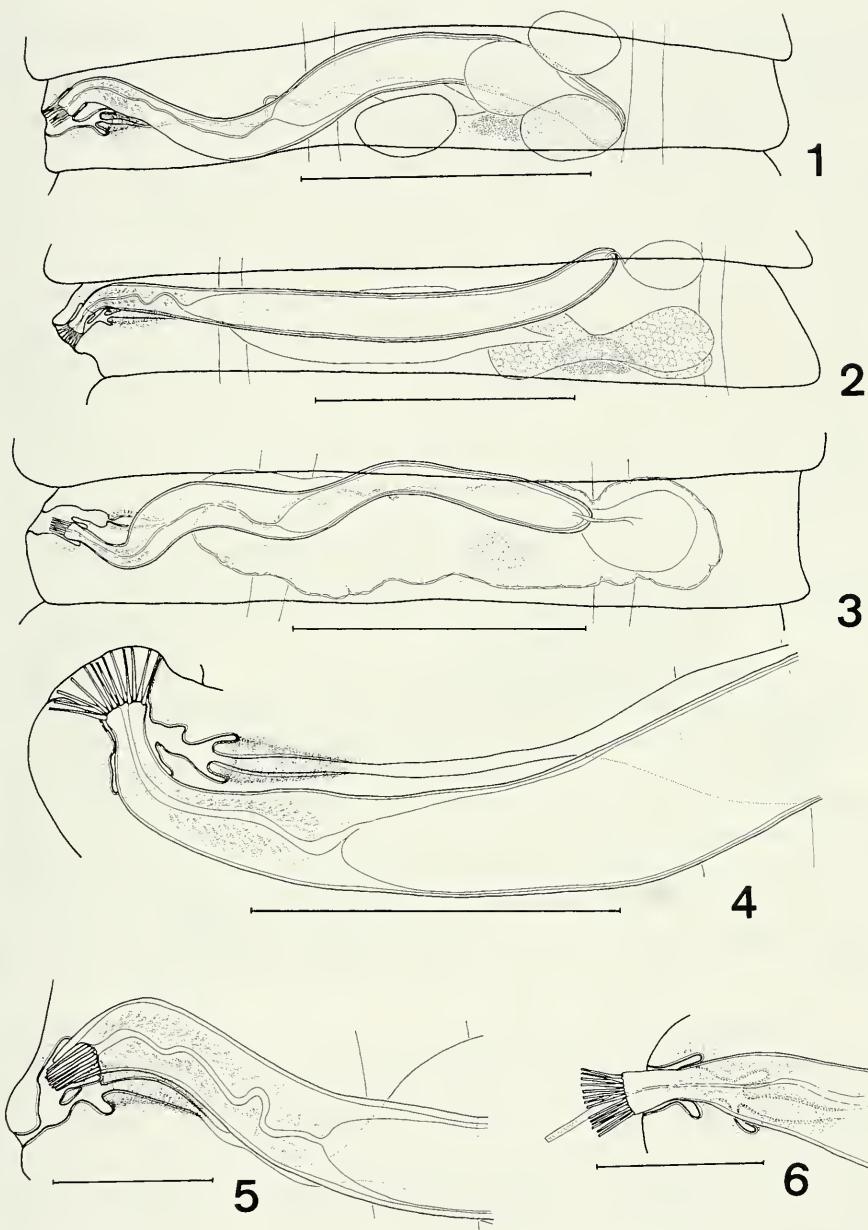
Female genital organs (Fig. 2) disposed antiporally. Ovary consisting of three compact lobes. Vitellarium compact, elliptical or oval, situated postero-ventrally to ovary. Seminal receptacle (Fig. 2) voluminous, transversely elongate, situated ventrally to cirrus-sac and dorsally to ovary. Vagina (Figs 4-5) opens on protrusible base of female atrial canal, often forming tiny papilla; vaginal orifice thick-walled, infundibular, with diameter 8-10 (8, n=10). Position of female atrial canal and vaginal orifice

TABLE I
Metrical and meristic data for *Dollfusilepis hoploporus* (Dollfus) comb. n.

Locality Source	Bulgaria Present study			Morocco Dollfus (1951)			Morocco Present study			Neuchâtel Present study		
	Range	Mean	n	Range	Range	Mean	n	Range	Mean	n		
Strobila:												
length (mm)	—	—	—	70	40	—	1	26.0	—	1		
width (mm)	—	—	—	1	0.6	—	1	0.3	—	1		
Scolex:												
length	—	—	—	—	—	—	—	188	—	1		
width	—	—	—	155	170	—	1	142	—	1		
Suckers: diameter	—	—	—	—	—	—	—	44-52	49	4		
Rostellum:												
length	—	—	—	—	—	—	—	62	—	1		
width	—	—	—	—	—	—	—	39	—	1		
Rostellar sheath:												
length	—	—	—	—	—	—	—	104	—	1		
width	—	—	—	—	—	—	—	64	—	1		
Rostellar hooks:												
total length	—	—	—	20-21	20-21	20	4	20-21	21	4		
length of blade	—	—	—	—	10-11	11	4	10-11	10	3		
Testes: diameter	26-34	30	30	25-30	31-36	33	10	31-39	37	20		
Cirrus-sac:												
length	180-232	203	20	170	160-186	173	10	216-238	229	20		
width	13-23	20	20	20	18-23	22	10	23-31	27	20		
Ext. seminal vesicle:												
length	31-64	41	20	—	41-67	57	10	62-129	85	15		
width	21-39	26	20	—	31-46	36	10	44-59	53	15		
Vitellarium:												
length	36-41	38	15	—	57-77	66	10	41-46	45	10		
width	18-23	20	15	—	41-46	43	10	28-34	31	10		
Seminal receptacle:												
length	90-121	106	15	—	90	—	1	129-162	147	10		
width	31-41	35	15	—	34	—	1	39-52	43	10		

to male pore not constant, usually posterior, often anterior or lateral. Copulatory part of vagina fusiform, thick-walled, muscular, 18-23 (20, n=10) long, surrounded by cellular sleeve. Conductive part tubular, slender, straight or slightly convoluted.

Developing uterus (Fig. 3) sac-like, transversely elongate, situated dorsally to female glands and osmoregulatory canals; passing beyond osmoregulatory canals. Proglottides with fully-developed uterus and ripe eggs not available.



FIGS 1-6

Dollfusilepis hoploporus (Dollfus, 1951) gen. n., comb. n., specimens from Bulgaria: 1-2, mature proglottides; 3, proglottis with developing uterus; 4-5, terminal genital ducts; 6, evaginated cirrus. Scale-bars: 1-3 = 100 µm; 4 = 50 µm; 5-6 = 25 µm.

OBSERVATIONS ON SYNTYPES (Figs 7-11; for some measurements see Table I): Most of the current observations are in agreement with the original description (DOLLFUS 1951) and, therefore, an entire redescription of the syntypes will not be given. The few details presented below extend or correct the original data.

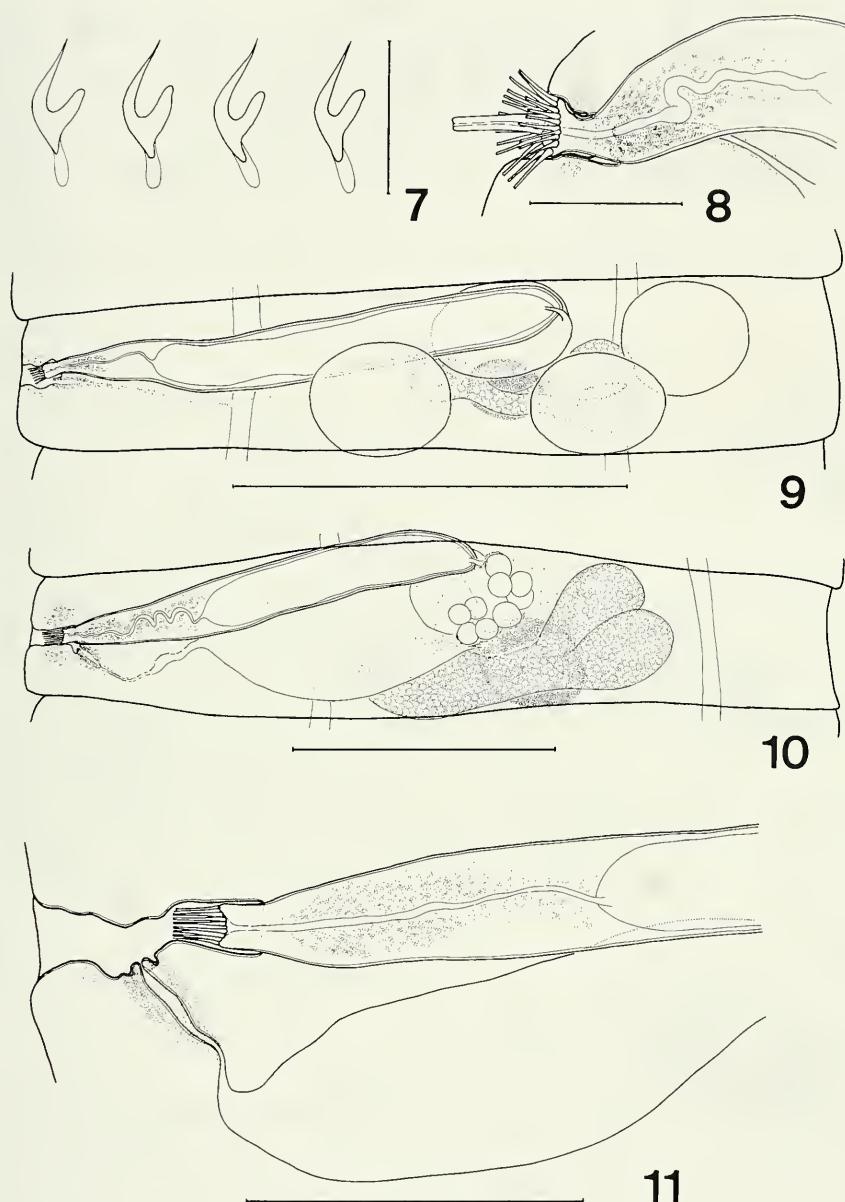
The position of the scolex in the slide does not permit us to characterize the structure of the suckers, the rostellum and the rostellar sheath. Rostellar hooks in number 10, with aploparaksoid refractive particle (Fig. 7) with length 16 ($n=4$); epiphyseal thickening of handle present; distance between handle-tip (of whole hook) and guard-tip 14 ($n=4$); distance between blade-tip and guard-tip 6-7 (7, $n=4$). Strobila fragmented. Testes (Fig. 9) arranged in triangle. External seminal vesicle oval. Cirrus-sac (Figs 9-10) crossing mid-line of proglottis; ductus ejaculatorius (Fig. 8) surrounded by intensely stained cells. Crown of baton-like, refractive spines on poral protrusible part of cirrus-sac (Fig. 8). Internal seminal vesicle very large, occupying almost 2/3 of cirrus-sac. Evaginated cirrus (Fig. 8) thin, almost cylindrical, unarmed. Ovary (Fig. 10) disposed antiporally, consisting of three compact lobes. Vitellarium well-visible, oval or elliptical, compact, postovarian. Seminal receptacle very large, situated postero-ventrally to cirrus-sac, dorsally to ovary. Young uterus (Fig. 10) sac-like, with poorly visible walls, situated anteriorly and dorsally to ovary. Developing uterus transversely elongate, crossing osmoregulatory canals dorsally. Proglottides with fully developed uterus and eggs not available.

OBSERVATION ON SPECIMENS FROM SWITZERLAND (Figs 12-16; for some measurements see Table I): Few details, mainly referring to the morphology of the scolex (lacking in the Bulgarian material and in poor condition in the syntypes), are presented below.

Scolex (Fig. 12) round, with maximum width at level of suckers. Suckers round, unarmed. Rostellum ovoid, with well-developed musculature; intensely stained cells situated in it. Rostellar sheath with weakly-developed musculature of walls, usually passing beyond posterior margin of suckers. Intensely stained cells present in rostellar sheath. Rostellar hooks (Fig. 13) with epiphyseal thickenings of handle; length of aploparaksoid refractive part 16-17 ($n=2$); distance between handle-tip (of whole hook) and guard-tip 14 ($n=2$); distance between blade-tip and guard-tip 8 ($n=2$).

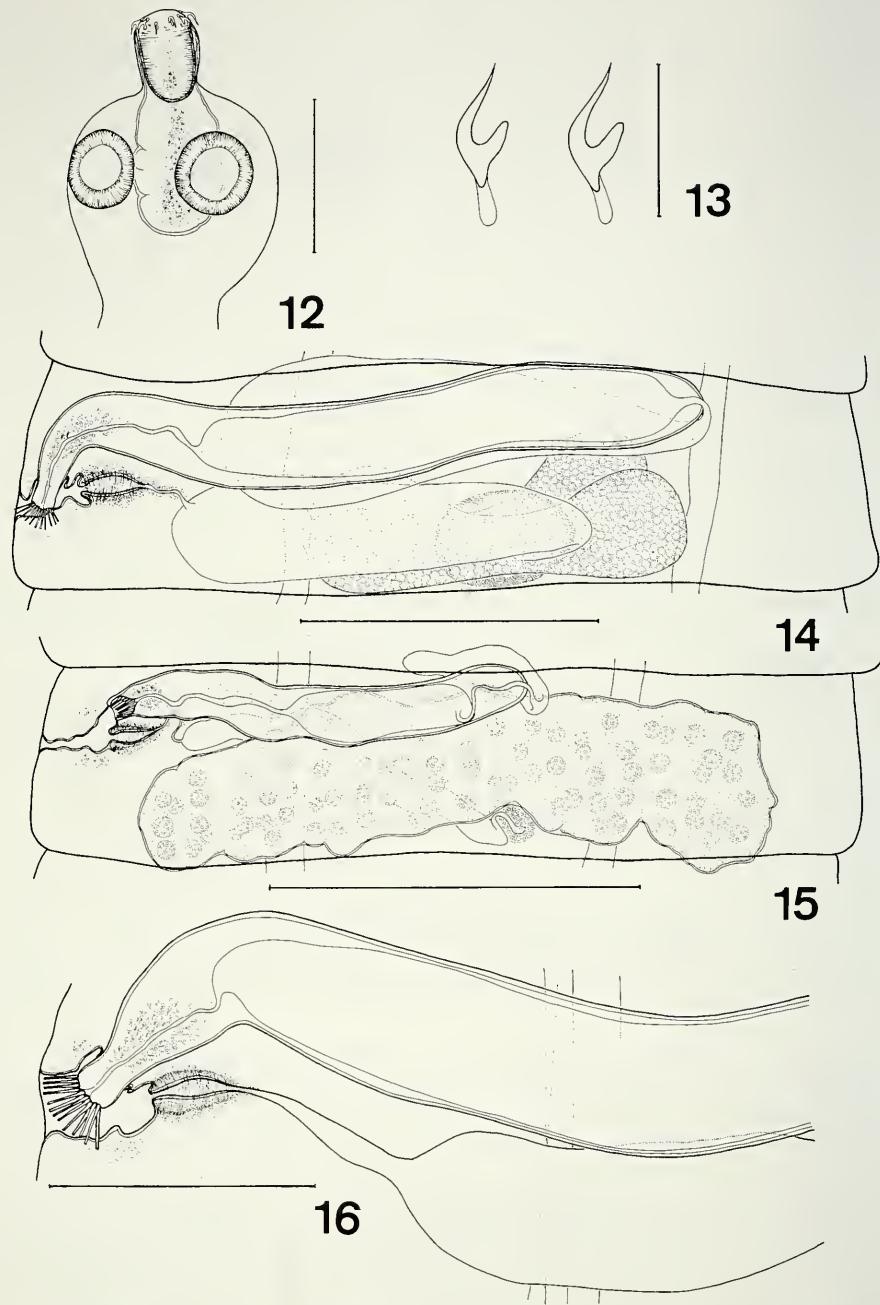
Diameter of ventral osmoregulatory canals 8-18 (12, $n=10$), diameter of dorsal osmoregulatory canals 3-8 (5, $n=10$). Genital atrium (Fig. 16) deep, antiporally divided into two separate canals. Cirrus-sac (Figs 14-15) thin-walled, highly elongate, crossing mid-line of proglottis and often extending to antiporal osmoregulatory canals. Poral part of cirrus-sac (Fig. 16) protrusible, armed with crown of baton-like spines. Cirrus thin, unarmed. Female genital glands disposed antiporally. Copulatory part of vagina (Fig. 16) with strong circular musculature. Proglottides with fully developed uterus and ripe eggs not available.

COMMENTS: Initially, these cestodes were recorded from *Podiceps cristatus* from the Lake of Neuchâtel and identified as *Hymenolepis capillaris* (Rudolphi, 1810) by JOYEUX & BAER (1950). Their conclusion was based mainly on the morphology of the



FIGS 7-11

Dollfusilepis hoploporus (Dollfus, 1951) gen. n., comb. n., syntype specimens: 7, rostellar hooks; 8, evaginated cirrus; 9, young mature proglottis; 10, mature proglottis with early stage of uterine development; 11, terminal genital ducts. Scale-bars: 7-8 = 20 µm; 9 = 150 µm; 10 = 100 µm; 11 = 50 µm.



FIGS 12-16

Dollfusilepis hoploporus (Dollfus, 1951) gen. n., comb. n., specimens from Switzerland: 12, scolex; 13, rostellar hooks; 14, mature proglottis; 15, proglottis with developing uterus; 16, terminal genital ducts. Scale-bars: 12, 14 = 100 µm; 13 = 20 µm; 15 = 150 µm; 16 = 50 µm.

rostellar hooks as described and figured by KRABBE (1869) (Pl. VII, Fig. 179). JOYEUX & BAER (1950) presented brief data about the morphology of the proglottides but did not describe the structure of the copulatory apparatus. By courtesy of Dr B. Neuhaus, we had the opportunity to reexamine the type-material of *H. capillaris* from the collection of the Naturkunde Museum, Berlin; its redescription, together with redescriptions of other species of the genus *Confluaria* Ablasov, will be subject of another publication (Vasileva, in preparation). In spite of the similar shape of the rostellar hooks, the morphology of the genital system of *C. capillaris* is very different from that of the cestodes from the Lake of Neuchâtel. As seen from the above description, this material should be referred to *D. hoploporus*.

DISCUSSION

The comparison of the present results about the morphology of *Hymenolepis hoploporus* with the hymenolepidid genera as characterized by CZAPLINSKI & VAUCHER (1994) reveals that this species is unique in the peculiar morphology of its male copulatory apparatus, which possesses a protrusible poral part of the cirrus-sac armed with a crown of baton-like spines.

The morphology of *H. hoploporus* fits to a group of avian hymenolepidid genera characterized by three testes, a rostellum armed with a single crown of 10 hooks and lacking an accessory sac and a cirrus-stylet. According to CZAPLINSKI (*in* CZAPLINSKI & VAUCHER 1994), this group includes *Nadejdolepis* Spasskii & Spasskaya, 1954, *Microsomacanthus* Lopez-Neyra, 1942, *Matiarensis* Dixit & Kapoor, 1986, *Parafimbriaria* Voge & Read, 1954, *Confluaria* Ablasov *in* Spasskaya, 1966 and *Wardium* Mayhew, 1925.

Hymenolepis hoploporus cannot be included in any of these genera. Its rostellar hooks are with an aploparaksoid refractive particle and possess well differentiated epiphyseal thickening of the handle whilst the species of the genera *Nadejdolepis* and *Microsomacanthus* have nitidoid and diorchoid hooks, respectively. The species belonging to *Wardium* also have 10 aploparaksoid hooks but without epiphyseal thickenings (CZAPLINSKI, *in* CZAPLINSKI & VAUCHER 1994). The genus *Matiarensis* is characterized by the presence of 4 accessory apical suckers. The species of *Parafimbriaria* lack external segmentation of the strobila.

The species of *Confluaria*, especially *C. capillaris*, most closely resemble *H. hoploporus*. They are also parasites of grebes and also have ten aploparaksoid hooks with epiphyseal thickenings, a tri-lobed ovary and a sac-like uterus. However, they are characterized by a long, cylindrical or claviform cirrus, armed usually with different types of spines: sparse, rose-thorn shaped spines at distal part of cirrus and dense, minute, needle-shaped spines at its basal part. *H. hoploporus* has a different structure of the copulatory apparatus. The genital atrium of the species of *Confluaria* is simple, whilst in *H. hoploporus* it is thick-walled and antiporally divided into two separate canals, male and female. The cirrus-sac of *Confluaria* spp. rarely crosses the mid-line of the proglottis, whilst that of *H. hoploporus* is very long, often extending to the antiporal osmoregulatory canals. These morphological peculiarities, in addition to

the armed protrusible poral part of the cirrus-sac, are not observed in species of *Confluaria*. Furthermore, *H. hoploporus* possesses numerous inner longitudinal muscle bundles; in contrast, *Confluaria* spp. are characterized with only 8 bundles (CZAPLINSKI, in CZAPLINSKI & VAUCHER 1994).

In addition, the genera *Microsomacanthus* and *Wardium* as defined by CZAPLINSKI (in CZAPLINSKI & VAUCHER 1994) seem to be heterogeneous groups. Therefore, the new genus has also to be distinguished from some of the genera believed to be their synonyms, especially those parasitizing aquatic birds and possessing, to some extent, similar morphological characters. The genus *Anserilepis* Spasskii & Tolkacheva, 1965 (type-species *Hymenolepis barrowensis* Schiller, 1952 from Anseriformes in Alaska and Siberia), as characterized by SPASSKII & TOLKACHEVA (1965), has 10 diorchoid hooks, female gonads situated antiporally to testes, and a cirrus armed with spines of three different shapes. *Dubininolepis* Spasskii & Spasskaya, 1954 (type-species *Hymenolepis fuhrmanni* Skrjabin and Matevosyan, 1942 from Gaviiformes and Podicipediformes in North America) is characterized by 8 inner longitudinal muscle bundles, a highly elongate rostellum, a deep rostellar pouch and rostellar hooks without epiphyseal thickenings (SPASSKAYA 1966). The species of *Echinatrium* Spasskii & Yurpalova, 1965 (type-species *E. skriabini* Spasskii & Yurpalova, 1965 from Anseriformes in Chukotka) possess 8 inner longitudinal muscle bundles and very deep genital atria (occupying almost one-fifth of the proglottis width) with spinose bases (SPASSKAYA 1966; TOLKACHEVA 1971). The genus *Laricanthus* Spasskii, 1963 (type-species *L. lateralis* (Mayhew, 1925) from Laridae) is characterized by 10 diorchoid rostellar hooks, a fan-shaped, multilobate ovary, a pyriform thick-walled cirrus-sac and highly muscular vagina (SPASSKAYA 1966). *Oshmarinolepis* Spasskii & Spasskaya, 1954 (type-species *O. microcephala* (Rudolphi, 1919) from Ardeidae) has testes situated in both median and lateral fields of the proglottis, 8 inner longitudinal muscle bundles and a strong, spherical genital atrium which may form a prominent genital papilla (SPASSKAYA 1966). *Chelacanthus* Yamaguti, 1959 (type-species *C. parviceps* (von Linstow, 1872) from birds of the tribe Mergini, Anatidae) possesses an armed vagina and a rosette-shaped ovary (YAMAGUTI 1959). *Decacanthus* Yamaguti, 1959 (type-species *D. arcticus* (Schiller, 1955) from Anseriformes in Alaska) has a rather short cirrus-sac which does not reach the median line of the proglottis, an ovary with "numerous digitiform lobules" and a vagina forming a characteristic loop (YAMAGUTI 1959). *Lobatolepis* Yamaguti, 1959 (type-species *L. lobulata* (Mayhew, 1925) from Podicipedidae in North America) has a rostellum provided with knob-like enlargement with 8-11 deep marginal lobes, each lobe bearing a rose-thorn rostellar hook, a rather short cirrus-sac and a transversely elongate ovary (YAMAGUTI 1959). None of the characters mentioned occurs in *H. hoploporus* and it cannot be placed, therefore, in any of the above discussed genera.

CZAPLINSKI (1967) redescribed *Wardoides nyrocae* (Yamaguti, 1935) from *Cygnus olor* (Gmelin) in Poland. This species is characterized by a thin cirrus with an unarmed base. According to CZAPLINSKI (1967), "the bottom of the genital atrium is armed with very small hair-like hooks; when the genital atrium is protruded... has the

shape of a surrounded hat..." (see Fig. 3 of CZAPLINSKI 1967). This structure of the genital atrium, mentioned also by YAMAGUTI (1935) in the original description of this species, is similar to the male copulatory apparatus of *H. hoploporus*. However, the armed, protrusible "hat-like" papilla of *W. nyrocae* is formed by the bottom of the genital atrium; in contrast, in *H. hoploporus* the poral part of the cirrus-sac is armed and forms a similar protrusible papilla. In the original description of *H. hoploporus*, DOLLFUS (1951) also regarded baton-like spines as an armament of the genital atrium.

On the basis of the above comparisons, the new monotypic genus *Dollfusilepis* is proposed for *H. hoploporus*.

Up to now, *D. hoploporus* has been recorded only from *P. cristatus* in three regions of the Palaearctic. Therefore, it can be supposed to be a specific parasite of this grebe species.

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